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closed-circuit coil and the disk. These currents are in approximately the same phase. If the closed-circuit coil be placed at an angle with the main coil, then there will be a rotation of the disk, the rotary effort increasing until the angle between the coils is forty-five degrees. The shaft of the disk is geared to a train of counting wheels, which record the number of revolutions. On the lower part of the shaft are light air-vanes to resist the rotation. When the closed-circuit coil is set, and we have an alternating current passing through the main coil, there is a rotary effort on the disk proportional to the current; there is a resistance to the motion due to the air-vanes and the friction of the pivots. It is found that the result is a speed proportional, within narrow limits, to the current passing in the main coil. The following figures are taken from the test of a 40-ampère meter:—

Current in Ampères.	Reading of Meter.	Percentage of Error.
2.06	1.60	—
4.02	4.07	+ 1.2
5.00	4.95	— 1.0
9.90	10.02	+ 1.2
15.00	15.10	+ 0.7
20.00	20.00	0.0
29.70	30.00	+ 1.0
37.40	37.00	— 1.1
49.30	45.40	— 7.9

In the last case the meter was overloaded. It would seem rather doubtful, however, even acknowledging the accuracy of the instrument tested, whether the friction of the moving parts will remain constant in use. Still experience must decide its practical value.

BOOK-REVIEWS.

A New English Dictionary on Historical Principles. Ed. by JAMES A. H. MURRAY. Part IV. Sections 1 and 2. Oxford, Clarendon Pr. f°. (New York, Macmillan, \$3.25.)

WE noticed the first instalment of this great work in *Science* for April 25, 1884, and we are now glad to chronicle the appearance of the fourth part, completing the first volume (A and B) and beginning the second. It is superfluous to praise the work, especially after the high commendations it has everywhere received. It is generally acknowledged to be the best dictionary of any language, and when finished will be indispensable to every thorough student of English. Both its etymologies and its definitions are up to the standard of the best scholarship, while in spelling and pronunciation it is probably as satisfactory as any dictionary of English can be. The typography also is excellent; the definitions, quotations, and other items under each word being clearly distinguished by different kinds and sizes of type. The number of illustrative quotations taken from some five thousand writers of the past seven centuries is immense; and in this respect, as well as in others, the work will serve as the basis of all English dictionaries hereafter.

The number of words in the first volume is 31,254, of which 15,123 are under A, and 16,131 under B. Some of these, however, are merely variant forms or inflections of the main words, while others are special combinations explained under the main words; so that the number of main words alone is only 22,232, of which 12,183 are under A, and 10,049 under B. In a dictionary dealing with seven centuries of English literature there are necessarily many obsolete words; and yet it is found, that, "of the whole English vocabulary on record since the twelfth century (so far as A and B show), more than three-fourths is still in current use." The development of the language in recent times, however, has been great, owing chiefly to the progress of physical science and the consequent introduction of new scientific terms. Yet the dictionary does not contain by any means all the terms used in science, but only such as are used more or less as English words; the generic names in natural history, for instance, being mostly excluded.

In a dictionary based on historical principles, the subject of

etymology is especially prominent; yet to ascertain the origin and derivation of some words has been found impossible, and the editor thinks that they are comparatively recent creations of the English-speaking peoples. Among such words he mentions 'bang,' 'blight,' 'blot,' 'blunder,' 'blunt,' 'bounce,' 'bunch,' and many others. One of the most valuable features of the work is the endeavor to trace, so far as possible, the derivation of the various meanings of a word from the original one. This subject is of great importance as illustrating the history of thought, and has been too much neglected by philologists hitherto. Sometimes the development of meaning is simple and easy to trace; but in some cases it is quite difficult, especially when the development takes place on divergent lines. For instance, the word 'canvas' is from the Latin *cannabis* ('hemp'), and the connection of most of its meanings with the original one can be readily traced; but, when used for the act of soliciting votes before an election, the affiliation is not apparent.

The difficulty of preparing such a work as this dictionary is immense. Its inception dates from a resolution of the English Philological Society passed in 1857, at the suggestion of the late Archbishop Trench. But before the composition of the dictionary could be begun, three and a half million quotations had to be made by some thirteen hundred readers; and the preparation of the work itself has proved much more difficult than the editors anticipated. Arrangements have been made, however, for more rapid progress hereafter; and Mr. Henry Bradley, who has been an assistant editor hitherto, is now engaged independently on the third volume, so that some of us, at least, may hope to see the completion of the work.

Facts and Opinions relating to the Deaf, from America. By ALEXANDER GRAHAM BELL. London. 8°.

THE above is the title of a pamphlet containing much valuable matter which Professor Bell collected in preparation of his report to the Royal Commission appointed by the British Government to inquire into the condition of the deaf. No one is so well fitted to be the spokesman of American activity in this direction as Professor Bell, and no one has proved himself more capable of increasing our knowledge of the deaf as a class, and the means of improving their condition. The report before us contains the answers of the superintendents of American schools for the deaf to a long circular letter drawn up by Professor Bell. Five general problems are discussed: (1) 'Visible Speech'; (2) the aural method; (3) intermarriage of deaf-mutes, and possibility of a deaf variety of the human race; (4) the self-supporting character of the education of deaf-mutes; (5) articulation-teaching.

(1) With regard to the use of 'Visible Speech,' the fact that of thirty-one institutions in which it has been introduced it has continued to be employed in only seventeen, argues against its universal applicability. The reasons for its dismissal are generally its difficulty of comprehension and tedium of learning. None the less, its hearty endorsement by so many superintendents shows that it has more in its favor than against it.

(2) The question of developing latent powers of hearing, and especially vocalization, in persons usually termed deaf but really only hard of hearing, is discussed at great length, with the general conviction that much more can be done in this direction than is usually understood. The good done in this way is not only a more or less questionable improvement of the physical hearing, but very markedly a direction of the attention to a class of sensations usually neglected, and thus increasing the accuracy of their perception. The mechanical aids to securing for the deaf a semi-hearing of their own articulations are various, and variously valued, though all seem susceptible of improvement.

(3) Doubtless the most important topic of the inquiry is that concerning the heredity of the deaf-mute class. Professor Bell, it is well known, has written a memoir urging that the tendency of the too close association of deaf-mutes with one another, as is now in vogue, is towards the formation of a deaf variety of the human race; his statistics proving that a constantly increasing proportion of the descendants of deaf-mute parents are deaf-mutes. The superintendents of schools, however, maintain that the bulk of their experience is against the truth of this thesis. Many recommend

celibacy, but urge, that, when marriage is looked forward to by the deaf, the union of two deaf persons is much surer of being attended with happiness than when one of the party is deaf and the other hearing, and that the slight and doubtful increase of a possible deaf offspring is more than outweighed by the social and personal comfort. Others draw a distinction between the intermarriages of the congenitally deaf and those who become so in mature years, urging that the probability of deaf descendants is far greater in the former case than in the latter. Many, too, regard consanguinity as a more potent factor in the production of deafness than deafness itself. Quite otherwise is the verdict given by such scientific men as Cope, Hyatt, Brewer, Newcomb, Brooks, and Bowditch. These men are unanimous in the opinion that deafness is essentially hereditary, and that the influences now in operation are similar in character to those that a breeder would furnish to bring about a variety with certain characteristics, and that these must tend towards perpetuating deafness as a constant characteristic of a certain portion of the human species. As a possible source of light in the matter, the suggestion may be offered that the heredity of deafness may vary greatly with the disease that led to it. So many cases of deafness are due to the after-effects of serious diseases, that here is a possible mode of reconciling the opposite experiences of different observers.

(4) and (5). Under these heads are given the various usages and modes of instruction in the schools of the country, with a more or less technical discussion of them.

In general, Professor Bell has succeeded in putting together much valuable matter relating to the deaf-mute class, and the presentation of this pamphlet to the royal commissioners must increase their estimation of the work of America in this field of applied science and applied philanthropy.

NOTES AND NEWS.

AMONG the publications of J. B. Lippincott Company announced as in press, we note 'An Elementary Treatise on Human Anatomy,' by Joseph Leidy; 'A Cyclopædia of Diseases of Children, and their Treatment, Medical and Surgical,' edited by J. M. Keating, M.D.; 'Life of Henry M. Stanley,' by Rev. H. W. Little; and 'Botany,' for academies and colleges, by Annie Chambers-Ketchum. — Ginn & Co. have in press 'Voices of Children,' a theoretical and practical guide on the topic, by W. H. Leib of the National Normal Music-School. — The October number of *Lippincott's Magazine* is a special E. P. Roe number, the first half of which is taken up with articles in one way or another commemorative of the dead novelist. — The Hon. Hugh McCulloch will discuss in *Scribner's Magazine* for October, free ships, revenue reform, immigration, and land-monopoly; and Prof. Arthur T. Hadley of Yale will contribute an article on 'The Railroad in its Business Relations.' — Ginn & Co. are to be the American publishers of the *Classical Review*, which is published in London, and numbers among its contributors the most eminent classical scholars of Great Britain. American scholars will be associated in the editorship.

— In a recent valuable and timely monographic paper upon the mesozoic mammals, Professor Osborn of Princeton has shown that the previously entertained views of the paucity of primitive mammalian life is not so great as has been supposed. No less than thirty-five genera are now known, including five from the trias, and one from what in all probability is correctly considered the most recent cretaceous. That all the vast gap of the cretaceous proper, so rich in vertebrate life, has not yet presented a single mammalian form, is marvellous. Scarcely less remarkable is the fact that among the known forms there is great diversity, the teeth showing six or seven wholly distinct types, "and this at a zoölogical period which we have been accustomed to consider as the dawn of mammalian life." Further, all these types, though primitive, are essentially mammalian, a single genus only showing any reptilian affinity. Very interesting, too, are the geographical and geological relationships of the genera. Among the thirteen or more North American Jurassic genera, six have their counterparts in English rocks, and the family relationships of all the rest are very close. One family, the *Plagiaulacidae*, has its members distributed in the

trias and Jurassic of both Europe and North America, the uppermost cretaceous of America, the lowest tertiary of France and America, and probably the post-tertiary of Australia, — truly a remarkable distribution, both geologically and geographically.

— In his 'Synopsis of the Families and Genera of the North American Diptera,' Dr. Williston has rendered a great service to the students of this neglected branch of entomology by bringing together in small compass so convenient and useful a series of tables. Some of these have been given before in different writings of the author, and he has compiled a part from the works of others; but in no place will the American student find so much comprised in so compact form. By means of it any student with tact can determine with considerable certainty to what genus any of his flies belong; excepting, indeed, in the case of some of the more difficult families which Dr. Williston has not attempted to include, such as the *Nematocera* and *Muscidae*, the latter the terror of systematists. Dr. Williston has added a bibliography supplementary to that given by Osten Sacken in his useful 'Catalogue of Diptera,' bringing the needed information regarding the literature of dipterology down to date. It should prove a stimulus to the study of the *Diptera*.

LETTERS TO THE EDITOR.

Recent Changes in the Magnetic Declination in Lower California.

REFERRING to an interesting note in *Science* for June 27, in which is given a brief account of magnetic observations lately made on the coast of Lower California and vicinity by officers of the United States steamship 'Ranger,' I beg leave to add some remarks further illustrating the change or reversal in the direction of the secular motion as noticed by the observers on the late cruise of the 'Ranger,' at Rosario Bay. While the fact is here established by direct observations, the phenomenon had already been recognized in a discussion made in the United States Coast and Geodetic Survey Office in January last, and the results were published by permission of the superintendent of the survey, at San Francisco, Cal., in the *Mining and Scientific Press* of Feb. 18, in an article on the 'Magnetic Variation on the Pacific Coast.' Not only the fact of the reversal, but the years of the reversal of the direction of the secular motion, that is, the years when the easterly declination (or so-called 'variation') ceased to increase and commenced to decrease, are there given as follows: at San Blas, Mex., in 1856; at Cape San Lucas, Lower California, in 1873; at Magdalena Bay in 1875; and on our own coast at San Diego (Cal.) in 1883, at Santa Barbara in 1880, while at Monterey the reversal is expected about 1899. The annual decrease of the declination as given in that article is as follows: —

Year.	San Blas.	San Lucas.	Magdalena Bay.	San Diego.	Santa Barbara.	Monterey.
1885	+ 2'.9	+ 1'.2	+ 1'.0	+ 0'.1	+ 0' 4	- 0'.9
1890	+ 3'.3	+ 1'.6	+ 1'.4	+ 0'.4	+ 0'.7	- 0'.6

The fixation of these dates became possible through the discovery by Assistant G. Davidson of the records of magnetic declinations made A.D. 1714 off the coast of Mexico, and transmitted by him to the Coast and Geodetic Survey Office, where they were discussed by Assistant C. A. Schott.

While the results published in February last supersede those given in the annual report for 1886 (Appendix No. 12, pp. 290-407), no improvement can be made in the expression for the secular variation of the declination at San Francisco, for which place the calculated reversal from increasing easterly to decreasing easterly declination is predicted for 1893. At that time the declination will not sensibly differ from 16°36' east, — its then extreme value. Owing to discord among the individual observations, these predicted years are subject to an uncertainty of several years; as shown, for instance, in the case of Monterey, for which the calculation appears to assign too late a date. The accurate observations